

Scientific - Technical Report

(2018 - 2020)

Competition:	Complex Ground-Breaking Research Projects_PCCF 2016
No. of the contract:	PN-III-P4-ID-PCCF-2016-0090
Research domain:	SH6_3
Title:	Hidden Landscapes: Exploratory Remote-sensing for the Archaeology of the Lost Roads, Borders and Battlefields of South-Eastern Carpathians
Acronym:	HiLands
Duration (months):	48
Project web page:	http://www.hilands.net4u.ro/
Host institution:	Romanian Academy Institute of Archaeology "Vasile Pârvan", Bucharest
Project manager	Valeriu Sîrbu
Project partner 1 (P1):	National Museum of Eastern Carpathians, Sfântu Gheorghe
Project partner 2 (P2):	"Carol I" Museum of Brăila, Brăila

Summary for publication.

1. Summary of the context and overall objectives of the project (for the 2018-2020 period, include the conclusions of the action)

*HiLands proposes a systematic approach of the **strategic circulation corridors** crossing the South-Eastern part of the Carpathian Mountains – the main gate used along ages by people transiting between Transylvania and the Danube or the Black Sea. In order to achieve such aims we are exploring, with frontier technologies, the circulation corridors' diachronic archaeological fingerprint, left in the **forested fortified landscapes**. We are conducting an unprecedentedly **massive airborne LiDAR** exploration (by airplane but also UAV based) along the major transit corridors: Rucăr-Bran, Tatar's road, Moldova Road through Oituz and along some of their variants, like the Middle Buzău valley and Dâmbovița valley. LiDAR exploration is followed by numerous geophysical prospections and pin-pointed archaeological excavations or surveys. Following the implementation of research activities in HiLands, will result a vast digital archive of archaeological sites and structures and micro-topographic anomalies, many known but, above all, some unknown, identified on a regional scale. The foundations of the typological, chronological and cultural classification of the identified and analysed structures will also be laid. The activity of the research team of the HiLands project will determine a significant conceptual change on the understanding of an archaeological heritage with universal value, but which has the full potential to reconsider the interpretation of some key events and periods in the history of Romania. For this reason HiLands is a frontier research project of national interest.*

Context: *With its fragmented geomorphology and mild ridges, the South-Eastern part of the Carpathians has been playing, since early prehistory, the role of main-avenue connecting Transylvania with the Danube and Black Sea. It is here, at the turnaround of the Carpathians, that three major mountain passes (Bran, Tatar and Oituz) allowing the commercial and military traffic on a systematic basis, converge all together into a single hub which is Bârsa Land. This fact had significant consequences in the regional organization of habitation, cultural patterns and power structures, along all ages. The geomorphological accessibility favoured, on part, the direct movement of people, goods and ideas, sometimes on large distances, coming from Central-Europe, Mediterranean or the North Pontic steppes, but, on the other hand, raised security problems for those communities located on either side of the Carpathians faced with such 'a gate'. During various times and under different political authorities, efforts were made to control the transit, defend or even block these passages. As*

a result, the ridge routes and mountain passes were marked by fortresses, watchtowers and various other defensive lines - vestiges of past stories about military strategies, battlefields, political interests, borderlines and cultural contact, but also about mobility and interaction along geomorphologically coherent pathways. High mountainous landscapes and large forested areas still represent virgin lands for archaeological exploration, especially in Romania. That is why the search for the missing links of many stories that unfolded along time on both sides of the Carpathians cannot progress without cutting edge technologies. It is the LiDAR the one technology that could significantly change the rules of the archaeological game by expanding exponentially the content of Romanian archaeological repertoires - with reasonable efforts and in a rather short period of time. LiDAR based survey in archaeology has the great potential to achieve simultaneously three important heritage related goals: identification, accurate spatial documentation and digital preservation and, what is more important, can achieve all of these in the forested areas where no archaeologist has gone before.



Objectives:

1. Exploration using LiDAR (aircraft) technology of at least 200 sq. km for the purpose of identifying and documenting archaeological sites, major communication corridors and battlefields in the Curvature Carpathians.

The exploration areas are as follows:

- a. the mountain sector of Limes Transalutanus (Câmpulung, Nămăești, Dragoslavele, Rucăr, Cetatea Carului, Bran)
- b. the Northern gate of the Buzău Road – the Tartar Road (Drajna de Sus, Slon, Tabla Butii, Vama Buzăului)
- c. the southern end of the Buzău Road on the Middle Buzău Valley
- d. the Moldova Road through the Oituz Pass
- e. the archaeological sites that close the mountain communication corridors from the Braşov Depression and the Târgu Secuiesc Depression
- f. key-archaeological sites that close the mountain communication corridors outside the Curvature Carpathians

HiLands is **designed to cover all the periods** during which major structures had been built along these corridors: Iron Age, Roman period, Middle Age, the period of the Austro-Hungarian administration and the First World War and, by doing so, to analyse the landscape in a diachronic manner, establishing its fourth dimension.

2. Experimental archaeological exploration using LiDAR technology (from UAV) of at least 20 sq. km in the area of the Curvature Carpathians in order to increase the applicability of the technology in the field of archaeology.

3. Establishing the methodological bases for the following border areas: archaeology of mountain areas, archaeology of forested areas, archaeology of battlefields, archaeology of the First World War

Estimated results: 1. digital archives of georeferenced sites and archaeological landscapes; 2. behavioural models regarding how people in the past exploited the mountainous landscapes or defined their borders, neighbours and enemies; 3 - new and innovative methods and workflows of archaeological research; 4 - development of applications based on portable LiDAR sensors mounted on UAVs.

The activities in the project have been divided in 5 main stages, corresponding with the unfolding years of the project:

I (2018) – Preliminaries (general data assessment, building GIS and data bases framework, pilot LiDAR acquisition flights);

II (2019) – Documentation of known sites (LiDAR, UAV, geophysics, archaeological field surveyed)

III (2020) – Exploration of uncharted territories (archaeological and LiDAR based);

IV (2021) – Data integration and exploration (expanding the data bases, filling the blanks); V (2022) – Behavioural modelling of mountainous landscape use (conceptual and theoretical syntheses).

After only 2.5 years, HiLands team has already recorded some **outstanding results**:

1. The areas covered by LIDAR survey (at 8 points/sq. m – the best possible resolution limited by Romanian legislation) are already 37 times larger than the value initially contracted for the entire project (200 sq. km initially promised). The in house data processing ensured a considerable lowering of costs. The processing of this huge amount of data sets (other than automatic classification) and their interpretation and field validation will surely expand outside the time span of the given project, influencing research for many years to come. Even if, in time, the access to LiDAR data will become democratized in Romania, like in other European archaeologies, the value of HiLands data sets will not diminish as they were recorded specifically for archaeological purposes and, through the established classes of anomalies, workflows and interpretative methods – a reference for any future similar endeavours.

2. Over 100 archaeological sites previously mentioned in the literature have been redocumented (68 with LiDAR technology and field survey and 37 just by field survey and geophysics). Of these 105 known sites - 25, even if already mentioned, were - before the Project - impossible to locate only with traditional technologies: Lost and found Roman marching camps, mountain isolated medieval monasteries (hermitages at Sărata Monteoru and Buda-Crăciunești, Buzău), Medieval and Prehistoric hillforts (Saciova, Sînzieni-Covasna), segments of Roman roads (Rucăr-Bran area), prehistoric tumuli cemeteries (in Argeş and Harghita counties). Even in the case of sites with known location, not all were included in RAN (National Archaeological Registry), like the Medieval fortification on Tipia Racoşului, Braşov (780 m altitude). The obtained detailed and revealing spatial documentation has helped and will help the process of official recognition (and protection), while also having the potential to reveal additional anthropic elements in relation to already known ones and establish connections with the surrounding landscape.

3. Using LIDAR exploration of forested areas along major circulation corridors, 44 new archaeological areas have been identified to date, spatially documented and confirmed in the field (while other 7 new sites were identified during traditional field survey), some at over 900 m altitude; of these many represent, not individual structures, but ensembles of anomalies: prehistoric hillforts, linear fortifications of composed of multiple segments, tumuli necropoleis, WW1 and WW2 battlefields, Austro-Hungarian border facilities or fortifications, vestiges of industrial landscapes of medieval or early modern period.

4. A portable LiDAR sensor was acquired, and expertise gained. The immense portability of Simultaneous Localization and Mapping technology (SLAM) ensured the documentation of caves (impossible with airborne LIDAR) and of small archaeological structures hidden in the forest which are easily overlooked in airborne data. The technology is used as a second level of spatial detailing for the identified anomalies.

5. 30 archaeological sites benefitted of geophysical prospections.

6. 90 site registration forms were already prepared for RAN registration (including of WW1 battlefields and earthworks) and others will follow.

7. An online data base (digital archive) of field surveyed sites within HiLands has been made public on the project website. This product will grow along with the on-going Project research and will function after the Project ends, as long as the data will continue to be analysed and verified in the field <https://hilands.net4u.ro/index.php/aisec>

8. A numismatic atlas of the South-Eastern Carpathians, encompassing discoveries for all periods, typical indicators for roads, have been made. The core of this atlas is in process of publication while a digital variant suitable for online presentation has already a pilot version.

During the remaining 20 months, the team will focus on exploring (with LiDAR and in the field) the blank areas – between known sites, along old roads, keeping the Digital Archives updated and integrate the new data in historical and cultural models.

